

CLAIMS

We claim:

1. A surgical instrument having a proximal end and a distal end, the instrument comprising:

5 a handle at the proximal end, the handle including a grip portion;

a hollow elongate support member extending distally from the handle and having a distal end at the distal end of the instrument;

a slide member having a proximal end and a distal end and a slot between the two ends, the slot extending in a proximal-distal direction;

10 a lever pivotally connected to the handle, the lever including a grip portion on one side of the pivotal connection and an integral drive portion on the other side of the pivotal connection, at least part of the drive portion comprising an integral cam received in the slot in the slide member;

a surgical implement having a proximal end connected to the distal end of the slide member, an elongate portion extending through the hollow elongate support, and a distal end;

a spring to urge the slide member toward the proximal end of the instrument;

wherein the slide member and elongate portion of the surgical implement are capable of being moved reciprocally in a linear proximal-distal direction by pivoting the

20 lever; and

wherein the surgical instrument is free of any mechanical connection between the lever and the slide member.

2. The surgical instrument of claim 1 wherein the handle has a proximal opening aligned with the slide member, a channel extending distally from the proximal opening, and an entry slot in communication with the channel, wherein the elongate portion of the surgical implement and slide member can be assembled into a subassembly by

5 connecting the elongate portion of the surgical implement to the slide member, and wherein the surgical instrument can be assembled by inserting the subassembly through the proximal opening in the handle, inserting the drive portion of the lever through the entry slot in the handle and into the slot in the slide member, and pushing the elongate portion of the surgical implement through the elongate support member.

10 3. The surgical instrument of claim 1 further comprising a housing around at least a portion of the slide member, wherein the elongate support member and surgical implement extend outward from the housing, and wherein the housing, slide member, elongate support member and surgical implement comprise a cartridge removable from the handle and lever.

15 4. The surgical instrument of claim 3 wherein the housing has a proximal opening aligned with the slide member, a channel extending distally from the proximal opening, and an entry slot in communication with the channel, wherein the elongate portion of the surgical implement and slide member can be assembled into a subassembly by connecting the elongate portion of the surgical implement to the slide member, and

wherein the cartridge can be assembled by inserting the subassembly through the proximal opening in the housing, inserting the drive portion of the lever through the entry slot in the housing and into the slot in the slide member, and pushing the elongate portion of the surgical implement through the elongate support member.

5     5.     A modular surgical instrument comprising:

an actuator module comprising:

10             a handle comprising a grip portion and an integral support portion, the support portion having proximal and distal ends and a support surface between the proximal and distal ends, the handle being substantially open above the support surface; and

              a lever pivotally connected to the support portion of the handle, the lever including a trigger portion and a drive portion, the trigger portion being longer than the drive portion, the drive portion extending through an opening in the support surface of the handle; and

15             a tool module comprising:

              a hollow housing having proximal and distal ends;

              a hollow elongate support member fixed to the distal end of the housing, the hollow elongate support member extending outwardly from the housing to a free distal end, the free distal end having an opening;

20             the hollow housing and hollow elongate support member defining an open passageway between them;

a surgical implement capable of reciprocal motion in the proximal-distal direction relative to the hollow elongate support member, at least part of the surgical implement extending through the hollow elongate support member and out through the opening at the free distal end of the elongate support member; and

5 a slide member operably connected to at least part of the surgical implement and being capable of reciprocal motion in the proximal-distal direction relative to the housing, the slide member having a drive surface;

wherein the actuator module and tool module are capable of being assembled and disassembled so that at least one of the modules can be reused independent of the other  
10 module, and

wherein when the actuator module and tool module are assembled the drive portion of the lever engages the drive surface of the slide member so that the slide member and surgical implement can be moved in the distal direction by squeezing the trigger portion of the lever.

15 6. The modular surgical instrument of claim 5 wherein the slide member has an elongate slot and the housing of the tool module has an opening aligned with the elongate slot so that the actuator module and tool module can be assembled by inserting the drive portion of the lever through the opening in the housing of the tool module and into the elongate slot in the slide member.

7. The modular surgical instrument of claim 5 wherein the surgical implement comprises a pair of elongate substantially flexible distance references connected at one end to the slide member in the housing and extending out of the free distal end of the elongate support member.

5 8. The modular surgical instrument of claim 7 wherein the free distal end of the elongate support member has substantially flat upper and lower surfaces and an interior wedge between the substantially flat upper and lower surfaces, the interior wedge diverging in the distal direction and defining two divergent passageways, and wherein one of the elongate substantially flexible distance references extends through one of the  
10 divergent passageways of the elongate support member and the other of the elongate substantially flexible distance references extends through the other of the divergent passageways of the elongate support member.

9. The modular surgical instrument of claim 5 wherein the surgical implement comprises a pair of elongate distance references connected at one end to the slide member  
15 in the housing and extending out of the free distal end of the elongate support member to free ends, the elongate distance references being made of a shape memory material and having at least one of the following unstressed shapes: substantially straight and parallel; and divergent at the free ends.

10. The modular surgical instrument of claim 5 wherein the surgical implement comprises an elongate rod and a tissue manipulator, wherein the elongate rod is received in the elongate support member and connected at one end to the slide member and at the other end to the tissue manipulator.
- 5 11. The modular surgical instrument of claim 5 wherein the surgical implement comprises a cannula, wherein the cannula is received in the elongate support member and connected at one end to the slide member.
12. The modular surgical instrument of claim 5 wherein the instrument comprises a kit including the actuator module and the tool module as separate elements of a kit.
- 10 13. The modular surgical instrument of claim 12 wherein the kit includes a plurality of tool modules.
14. The modular surgical instrument of claim 5 wherein the handle is sized and shaped to support the housing of the tool module and to limit relative proximal-distal movement between the housing of the tool module and the handle.
- 15 15. The modular surgical instrument of claim 5 wherein at least one of the actuator module and tool module includes a spring for urging the slide member toward the proximal end of the housing.

16. A disposable surgical tool module for use with a separate actuator module, the surgical tool module comprising:

a housing having proximal and distal ends;

a hollow elongate support member at the distal end of the housing, the hollow

5 elongate support member extending outwardly from the housing to a free distal end, the free distal end having an opening;

a surgical implement capable of reciprocal motion in the proximal-distal direction, at least part of the surgical implement extending through the hollow elongate support member and out through the opening at the free distal end of the elongate support member; and

10 a slide member operably connected to at least part of the surgical implement and being capable of reciprocal motion in the proximal and distal directions, the slide member having a slot;

the housing having an opening aligned with the slot of the slide member;

15 the tool module being free from any structure for moving the slide member in the proximal direction.

17. The disposable surgical tool module of claim 16 wherein the surgical tool module comprises part of a kit, the kit further including an actuator module including a handle for receiving and supporting the housing of the surgical tool module and a lever pivotally

20 attached to the handle.

18. The disposable surgical tool module of claim 16 wherein the surgical implement comprises at least one of the following:

a pair of elongate substantially flexible distance references connected at one end to the slide member in the housing and extending out of the free distal end of the elongate

5 support member;

an elongate rod and a tissue manipulator, wherein the elongate rod is received in the elongate support member and connected at one end to the slide member and at the other end to the tissue manipulator; and

a cannula connected at one end to the slide member.

10 19. The disposable surgical tool module of claim 16 further comprising a spring in the housing for urging the slide member toward the proximal end of the housing.

20. The disposable surgical tool module of claim 16 wherein the free distal end of the elongate support member has substantially flat upper and lower surfaces and an interior wedge between the substantially flat upper and lower surfaces, the interior wedge

15 diverging in the distal direction and defining two divergent passageways, and wherein the surgical implement comprises a pair of elongate substantially flexible distance references, wherein each distance reference extends through one of the divergent passageways of the elongate support member.



21. The disposable surgical tool module of claim 16 wherein the surgical implement comprises a pair of elongate distance references connected at one end to the slide member in the housing and extending out of the free distal end of the elongate support member to free ends, the elongate distance references being made of a shape memory material and  
5 having at least one of the following unstressed shapes: substantially straight and parallel; and divergent at the free ends.

22. A surgical instrument having proximal and distal ends comprising:

a handle at the proximal end, the handle including a grip portion;

a hollow elongate support member extending outward from the handle in a distal

10 direction;

a surgical implement extending through the elongate support member and capable of reciprocating in the proximal-distal direction in the elongate support member;

a lever pivotally connected to the handle, the lever including a trigger portion and a drive portion, the trigger portion being longer than the drive portion, the lever extending  
15 through an opening in the handle; and

a slide member having a drive surface engaging the drive portion of the lever, the slide member being capable of reciprocal motion in the proximal-distal direction;

wherein the surgical implement comprises a pair of elongate substantially flexible distance references connected at one end to the slide member and extending out of the

20 distal end of the elongate support member;

wherein the elongate support member has a substantially cylindrical portion and a pair of discrete elongate tubes extending from the substantially cylindrical portion to beveled distal ends, the discrete elongate tubes having substantially parallel portions and curved divergent portions; and

5            wherein one of the elongate substantially flexible distance references extends through one of the discrete elongate tubes and the other elongate substantially flexible distance reference extends through the other of the discrete elongate tubes, and wherein each elongate substantially flexible distance references has a beveled distal end.

23.        The surgical instrument of claim 22 wherein the curved portion of each discrete  
10        elongate tube has a radius of curvature greater than five inches.

24.        The surgical instrument of claim 22 further comprising a wedge between the curved portions of the discrete elongate tubes, the wedge including distance indicia.

25.        A surgical instrument having proximal and distal ends comprising:

            a handle at the proximal end, the handle including a grip portion;

15           a hollow elongate support member extending outward from the handle in a distal direction;

            a surgical implement extending through the elongate support member and capable of reciprocating in the proximal-distal direction in the elongate support member;

a lever pivotally connected to the handle, the lever including a trigger portion and a drive portion, the trigger portion being longer than the drive portion, the lever extending through an opening in the handle; and

a slide member having a drive surface engaging the drive portion of the lever, the  
5 slide member being capable of reciprocal motion in the proximal-distal direction;

wherein the surgical implement comprises a pair of elongate substantially flexible distance references connected at one end to the slide member and extending out of the distal end of the elongate support member;

wherein the elongate support member has a substantially cylindrical portion and a  
10 non-cylindrical distal end, the distal end having substantially flat upper and lower surfaces and an interior wedge between the substantially flat upper and lower surfaces, the interior wedge diverging in the distal direction and defining two divergent passageways; and

wherein one of the elongate substantially flexible distance references extends  
15 through one of the divergent passageways of the elongate support member and the other of the elongate substantially flexible distance references extends through the other of the divergent passageways of the elongate support member.

26. The surgical instrument of claim 25 wherein the substantially flat upper and lower surfaces of the elongate support member include distance indicia.

27. The surgical instrument of claim 25 further comprising a housing around at least a portion of the slide member, wherein the elongate support member and surgical implement extend outward from the housing, and wherein the housing, slide member, elongate support member and surgical implement comprise a cartridge removable from the handle and lever.

28. The surgical instrument of claim 25 wherein the slide member includes a slot with an end surface that defines the drive surface of the slide member, and wherein part of the drive portion of the lever is received in the slot of the slide member.

29. The surgical instrument of claim 28 wherein the drive portion of the lever includes a cam surface engaging the drive surface of the slide member.

30. The surgical instrument of claim 25 wherein the slide member includes a slot with an end surface that defines the drive surface of the slide member, the housing includes a slot aligned with the slot of the slide member, and wherein part of the drive portion of the lever extends through the slot in the housing to be received in the slot of the slide member.

31. The surgical instrument of claim 25 wherein the handle includes a plurality of slots sized and positioned for cleaning the handle.

32. The surgical instrument of claim 25 further comprising a movable measuring indicator pin connected to the slide member to move with the slide member, the surgical instrument further comprising fixed measuring indicia adjacent to the movable measuring indicator pin.

5 33. The surgical instrument of claim 32 further comprising a screw for adjusting the position of the slide member and indicator pin in the proximal-distal direction.

34. The surgical instrument of claim 25 wherein the instrument is free from any mechanical connection between the lever and the slide member.

35. The surgical instrument of claim 25 wherein the cylindrical portion has a diameter  
10 less than the maximum transverse dimension of the distal end portion of the elongate support member.

36. The surgical instrument of claim 35 wherein the maximum transverse dimension of the distal end portion of the elongate support member is no more than 6 mm.

37. The surgical instrument of claim 36 wherein the diameter of the substantially  
15 cylindrical portion of the elongate support member is less than the maximum transverse dimension of the distal end portion.

38. The surgical instrument of claim 25 wherein the substantially cylindrical portion of the elongate support member has a single common channel and in which both elongate substantially flexible distance references are positioned within the single common channel.

5 39. The surgical instrument of claim 25 wherein the distal end of the hollow elongate support member has curved surfaces connecting the flat upper and lower surfaces, wherein each of the flat upper and lower surfaces has a distal apex and diverging edges extending from the distal apex in a proximal direction, and wherein the apex of each of the flat upper and lower surfaces comprises a radius.

10 40. The surgical instrument of claim 25 wherein the wedge defines an angle of from about 30° to 45°.

41. The surgical instrument of claim 25 wherein the slide member has a fully retracted position, a fully extended position, and a longitudinal range of travel between the fully retracted and fully extended positions, and wherein the longitudinal range of  
15 travel of the slide member is between about 20 mm and about 45 mm.

42. The surgical instrument of claim 25 wherein the handle includes a housing with proximal and distal ends, the housing having openings at the proximal and distal ends and defining a channel extending between the openings at the proximal and distal ends,

wherein the slide member is received in the channel of the housing and part of the elongate support member is received in the channel.

43. The surgical instrument of claim 42 wherein:

the slide member has proximal and distal ends and the elongate support member  
5 has proximal and distal ends;

the flexible distance references are attached to the distal end of the slide member;

the distal end of the slide member is longitudinally spaced from the proximal end  
of the elongate support member;

wherein the slide member and flexible distance references are capable of moving  
10 distally through the space between the slide member and the elongate support member.

44. The surgical instrument of claim 43 further comprising a screw at the proximal end of the housing in contact with the proximal end of the slide member and a spring in the channel surrounding part of the slide member.

45. The surgical instrument of claim 44 wherein the slide member has a longitudinal  
15 axis that passes through the screw, slide member and lever but no other component between the proximal end of the housing and the proximal end of the elongate support member.